

BASIS FOR THE AMENDMENT

Claim 62 has been canceled.

Claim 26 has been amended as supported at page 50, lines 13-24 of the specification.

New Claim 64 is supported by the Examples.

New Claims 65 and 66 are supported at page 49, lines 8-12, of the specification.

No new matter is believed to have been added by entry of this amendment. Entry and favorable reconsideration are respectfully requested.

Upon entry of this amendment Claims 1, 2, 7-26, 28-32, and 47-51, 58-61, 63-66 will now be active in this application. Claims 1, 2, 7-25, 28-32 and 47-50 stand withdrawn from further consideration.

REMARKS

Applicants respectfully request reconsideration of the application, as amended, in view of the following remarks.

The present invention as set forth in **amended Claim 26** relates to a coating liquid for an outermost layer of an electrophotographic photoreceptor, comprising:

an alumina filler;

an organic compound having an acid value of from 10 to 700 mgKOH/g;

a binder resin; and

plural organic solvents;

wherein said organic compound is an unsaturated polycarboxylic acid polymer or copolymer;

wherein a content of said organic compound is determined so as to satisfy the relationship:

$$0.1 \leq (A \times B/C) \leq 20;$$

wherein A represents the content of the organic compound in units of grams, B represents the acid value of the organic compound in units of mgKOH/g and C represents the content of the filler used in units of grams;

wherein said coating liquid is prepared by mixing the filler, the organic compound, the binder resin and the plural organic solvents using a ball mill containing only alumina balls.

Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination, fail to disclose or suggest a coating liquid as claimed comprising an **organic compound which is an unsaturated polycarboxylic acid polymer or copolymer;**

wherein a content of said organic compound is determined so as to satisfy the relationship:

$$0.1 \leq (A \times B/C) \leq 20;$$

wherein A represents the content of the organic compound in units of grams, B represents the acid value of the organic compound in units of mgKOH/g and C represents the content of the filler used in units of grams.

Notably, the use of the claimed polycarboxylic acid polymer or copolymer in the claimed amount having the claimed acid value enhances dispersion stability and dispersion efficiency of the filler. See for examples page 45, line 24 to page 50, line 24 of the specification. This is not disclosed or suggested by Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination.

Page 45, line 24 to page 50, line 12 states:

“In order to decrease the residual potential of the resultant photoreceptor and to improve the dispersion and stability of the filler used, organic compounds, in particular wetting dispersants, which have a hydrophobic group such as hydrocarbon groups and a hydrophilic group such as a carboxyl group and which have an acid value of from 10 to 700 mgKOH/g are preferably used. The reason why the increase of the residual potential can be prevented is considered to be that the compounds have a proper acid value and are easily adsorbed on the filler used.

When a filler is added to an outermost layer, the polar groups present on the surface of the filler serve as charge trap sites, resulting in increase of the residual potential of the resultant photoreceptor. When such a wetting dispersant as mentioned above is added thereto, the hydrophilic group (such as a carboxyl group) of the wetting dispersant tends to be adsorbed on the polar groups of the filler, resulting in decrease of the residual potential.

On the other hand, in order to improve dispersion of a filler in a layer including a binder resin, the affinity of the filler to the binder resin should be heightened to wet the filler with the binder resin. In addition, interaction between the filler particles should be decreased to improve the stability of the filler.

The wetting dispersants having the above-mentioned structure, i.e., a structure like a surfactant, which includes both a hydrophobic group and a hydrophilic group therein, are used, the hydrophilic group is adsorbed on the polar groups, which serve as trap sites, while the hydrophobic group has an affinity to the binder resin. Thus, the

wettability of the filler can be improved. In addition, the molecules adsorbed on the filler cause electric repulsion and steric hindrance, resulting in prevention of contact of the filler particles, and thereby the dispersion stability of the filler can be improved.

Thus, wetting dispersants, which are defined to have both a wetting ability of improving the wettability of a filler and a dispersing ability of improving the dispersion stability of the filler, can be preferably used to impart both wettability and dispersion stability to the filler. When one of the wetting ability and dispersing ability is lacked, problems occur such that dispersion is not satisfactory, dispersion efficiency is not satisfactory and/or dispersion stability is not satisfactory.

These wetting dispersants have good ability to be adsorbed on a filler and a structure which can produce good steric hindrance effect, and therefore the filler used can be imparted with good dispersion stability. Therefore, such wetting dispersants are preferably used.

As the hydrophilic group, --SO₃Na, --COOK, --COONa, --COO--, --COOH, --OH, --O--, --CH₂CH₂O--, a quaternary ammonium salt group, etc. can be exemplified. In the present invention, when the hydrophilic group is a carboxyl group (i.e., --COOH), the wetting dispersant effectively imparts high dispersibility to the filler while not affecting the electrostatic properties of the resultant photoreceptor and the image qualities of images produced by the photoreceptor. Therefore wetting dispersants having a carboxyl group can be preferably used. The desired effect of the hydrophilic group such as a carboxyl group can be exerted even when one hydrophilic group is included in an organic molecular structure including a hydrophobic group such as hydrocarbon groups. **However, when a polycarboxylic acid which has a number of carboxyl groups therein is used, the anionic property of the compound increases, and thereby the dispersion stability of the filler can be further improved and in addition, dispersion efficiency can be dramatically improved.**

In addition, when a polycarboxylic acid is used, precipitation of the filler used can be prevented because the carboxyl groups in the polycarboxylic acid have an affinity to each other. Further, when a hydrophilic group such as a carboxyl group is located at the end position of the molecule of a wetting dispersant, the dispersant is easily adsorbed on the filler used. Therefore such wetting dispersants are preferably used in the present invention. In addition, addition of a wetting dispersant having a hydrophilic group at the end position thereof has an effect on prevention of precipitation of the filler used. Specific examples of such polycarboxylic type wetting dispersants include BYK-P104 manufactured by BYK CHEMIE Co., etc.

In addition, to allow a wetting dispersant to be effectively adsorbed on a filler improves dispersion of the filler and decreases residual potential, and in addition improves the abrasion resistance of the resultant outermost layer. The reason is considered to be as follows.

In general, since a filler has a poor affinity to a binder resin, i.e., the adhesion of the filler to the binder resin is poor, the filler tends to be easily released from the binder resin. By adding one or more of the wetting dispersants mentioned above, the affinity of the filler to the binder resin can be enhanced, resulting in prevention of releasing of the filler from the binder resin, and thereby the abrasion resistance of the resultant

layer can be improved.

The molecular weight of the organic compound having an acid value of from 10 to 700 mgKOH/g, such as the wetting dispersants mentioned above, for use in the present invention is preferably from 300 to 30,000, and more preferably from 400 to 10,000 in number average molecular weight. Namely, polymers and oligomers are preferably used. When the molecular weight is too low, desired steric hindrance cannot be produced when the dispersant is adsorbed on a filler, resulting in increase of interaction between filler particles, and thereby the dispersion and dispersion stability of the filler are deteriorated. To the contrary, when the molecular weight is too high, wettability and an ability to be adsorbed on a filler deteriorate. In addition, plural filler particles are adsorbed on a wetting dispersant polymer, resulting in agglomeration of the filler particles.

The acid value of the organic compound for use in the present invention is preferably from 10 to 700 mgKOH/g, and more preferably from 30 to 400 mgKOH/g. When the acid value is too high, the resistance of the filler tends to be excessively decreased, resulting in occurrence of the blurred image problem. To the contrary, when the acid value is too low, the addition quantity has to be increased, and in addition increase of residual potential cannot be fully prevented. It is preferable that the addition quantity of the organic compound should be determined while considering the acid value of the organic compound. However, when organic compounds having different acid values in the range of from 10 to 700 mgKOH/g are used while the content of each organic compounds is constant, the residual potential decreasing effect does not necessarily depend on the acid value thereof. This is because the residual potential decreasing effect also depends on the ability of the compound to be absorbed on the filler.

Emphasis added.

The superior properties obtained when using the claimed polycarboxylic acid polymer or copolymer in the claimed amount having the claimed acid value is not disclosed or suggested by Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination.

Further Examples 9, 10 and 11 use various unsaturated polycarboxylic acid polymers. Examples 12-26 are based on Example 10. In addition, unsaturated polycarboxylic acid is **not** used in Comparative Examples 1 (and 2-9). The Table 1 below (from pages 108-110 of the specification) shows that inferior properties are obtained if **no** unsaturated polycarboxylic acid is used.

The specification discloses at page 110, lines 6-20:

“As can be understood from Table 1, by adding an organic compound having an acid value of from 10 to 700 mgKOH/g, the average particle diameter of the solid components of the coating liquids can be decreased, and thereby precipitation of the filler can be prevented and dispersion of the filler can be improved. In addition, a wetting dispersant is used as the organic compound having an acid value of from 10 to 700 mgKOH/g, dispersion of the filler can be further improved and stability of the dispersion of the filler can also be enhanced.

To the contrary, when such an organic compound is not added or an organic compound having an acid value less than 10 mgKOH/g is added, the average particle diameter of the solid components increases and precipitation of the filler increases (i.e., dispersion of the filler seriously deteriorates due to agglomeration of the filler).”

Further, Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination, fail to disclose or suggest a coating liquid as claimed said coating liquid being prepared by mixing **the alumina filler**, the organic compound, the binder resin and the plural organic solvents using a **ball mill containing only alumina balls**.

The specification of the present invention discloses at page 71, lines 5-10 that:

When alumina is used as a dispersing element, the abrasion amount of alumina is much less than zirconia, and therefore the influence on residual potential is very little. Therefore alumina is preferable as the dispersing element. In addition, it is preferable to use alumina as a filler when alumina balls are used as the dispersing element.

In addition, the Examples in the present specification show that **when only alumina balls are used**, the filler can be finely dispersed and excellent dispersion stability can be achieved. See the Examples starting at page 94 of the specification which were performed using different resins, monocarboxylic acid derivatives and fillers and wetting dispersants in various amounts. Notably, Examples 10, 25 and 26 (**all using unsaturated polycarboxylic acid polymers**) are a direct comparison between using alumina balls and zirconia balls or a shaker instead of a ball mill. Example 10 had no precipitation after one day after the preparation, while in Examples 25 and 26 there is a small amount of precipitate after only one day. Clearly, using a ball mill that has only alumina balls results in superior dispersion stability and a coating having a uniform distribution of the filler can be obtained. However, if

there is a precipitate in the coating liquid, the resulting coating cannot have a uniform distribution of the filler. Table 1 from pages 108-110 of the specification is reproduced below.

Table 1

		Filler	AV* ¹ (mgKOH /g)	Addi- tion amount * ² (parts)	PD* ³ of filler (μ m)	PD* ⁴ Of Liquid (μ m)	Pre- cipi- tation
Example	1	Alumina	35	0.60	0.3	0.71	○
	2	Alumina	65	0.30	0.3	0.65	○
	3	Alumina	200	0.20	0.3	0.61	○
	4	Alumina	130	0.20	0.3	0.59	○
	5	Alumina	95	0.20	0.3	0.50	◎
	6	Alumina	160	0.12	0.3	0.53	◎
	7	Alumina	129	0.03	0.3	0.47	◎
	8	Titanium oxide	129	0.03	0.3	0.51	◎
	9	Alumina	150	0.06	0.3	0.48	◎
	10	Alumina	180	0.06	0.3	0.42	◎
	11	Alumina	365	0.03	0.3	0.39	◎
	12	Alumina	180	0.01	0.3	0.57	◎
	13	Alumina	180	0.20	0.3	0.40	◎
	14	Alumina	180	0.06	0.2	0.37	◎
	15	Alumina	180	0.06	0.9	1.06	○
	16	Alumina	180	0.06	0.013	0.21	◎
	17	Titanium oxide	180	0.06	0.3	0.46	◎
	18	Alumina treated with titanate coupling agent	180	0.06	0.3	0.36	◎

Comparative Example	19	Titanium oxide treated with aluminum stearate	180	0.06	0.03	0.27	◎
	20	Titanium oxide treated with silane coupling agent	180	0.06	0.015	0.31	○
	21	Alumina	180	0.06	0.3	0.62	○
	22	Alumina	180	0.06	0.3	0.45	◎
	23	Alumina	180	0.06	0.3	0.52	◎
	24	Alumina	180	0.06	0.3	0.70	○
	25	Alumina	180	0.06	0.3	0.51	○
	26	Alumina	180	0.06	0.3	0.48	○
	1	Alumina	—	0	0.3	1.23	×
	2	Titanium oxide	—	0	0.3	1.15	×
	3	Alumina treated with titanate coupling agent	—	0	0.3	0.88	△
	4	Titanium oxide treated with silane coupling agent	—	0	0.015	0.51	×
	5	Alumina	—	0	0.3	1.16	×
	6	Alumina	7	0.60	0.3	1.08	×
	7	Alumina	7	1.20	0.3	0.96	×
	8	Alumina	7	0.60	0.013	0.58	×
	9	Alumina treated with titanate coupling agent	7	0.60	0.3	0.75	○
	10	Alumina	—	0.06	0.3	0.92	×

*1: Acid value of the organic compound

*2: Addition amount of the organic compound

*3: Average primary particle diameter of the filler

*4: Average particle diameter of the solid components in the coating liquid.

Further, Applicants previously submitted a **Rule 132 Declaration** showing that by using ball milling, the filler can be finely dispersed while the dispersion has good dispersion stability. This cannot be achieved with the methods of Nakao et al, and Kanamori et al in view of Patzschke et al. In addition, the use of alumina balls results in a superior product compared to a product obtained using zirconia balls or glass balls. It is shown that even when a ball mill is used, the dispersibility and dispersion stability of the resultant dispersions depends on the dispersion media (i.e. balls). This is not disclosed or suggested by Nakao et al, and Kanamori et al in view of Patzschke et al. Using the method according to Claim 26, superior dispersibility and dispersion stability can be obtained.

Further, the dispersion maintains good dispersibility for a long period of time. Therefore, the filler is uniformly dispersed in a protection layer (an outermost layer) formed using the dispersion. As a result, good mechanical durability can be imparted to the protective layer and a residual potential of the resultant photoreceptor can be decreased.

Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination, fail to disclose or suggest a coating liquid as claimed in amended Claim 26 which is prepared by mixing **the alumina filler**, the organic compound, the binder resin and the plural organic solvents using a **ball mill containing only alumina balls**.

Claim 60 relates to a coating liquid for an outermost layer of an electrophotographic photoreceptor, comprising:

an alumina filler;

a polycarboxylic acid having an acid value of from 10 to 700 mgKOH/g;

a binder resin; and

plural organic solvents.

New Claim 61 relates to a coating liquid for an outermost layer of an electrophotographic photoreceptor, comprising:

an alumina filler;

an polycarboxylic acid having an acid value of from 10 to 700 mgKOH/g;

a binder resin; and

plural organic solvents;

wherein said coating liquid is prepared by mixing the filler, the organic compound, the binder resin and the plural organic solvents using a ball mill containing only alumina balls.

New Claims 63 and 64 further limit the compounds to those used specifically in the examples.

The Examiner has admitted in the Office Action of May 24, 2007, that the alumina ball mill improves the dispersion of the exemplified composition containing alumina filler and a polycarboxylic acid polymer. Thus, Claims 60-63 should be allowable.

Thus, the rejections over Nakao et al, and Kanamori et al in view of Patzschke et al, alone or in combination, should be withdrawn.

Finally, Applicants note that MPEP 821.04 states, "if applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims which depend from or otherwise include all the limitations of the allowable product claim will be rejoined." Applicants respectfully submit that should the elected group be found allowable, the non-elected claims should be rejoined.

With respect to the elected species, Applicants respectfully submit that, should the elected species be found allowable, the Office should expand its search to the non-elected species.

Application No.: 10/827,376

Reply to the Office Action dated: September 6, 2007


This application presents allowable subject matter, and the Examiner is kindly requested to pass it to issue. Should the Examiner have any questions regarding the claims or otherwise wish to discuss this case, he is kindly invited to contact Applicants' below-signed representative, who would be happy to provide any assistance deemed necessary in speeding this application to allowance.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Customer Number

22850


J. Derek Mason, Ph.D.
Registration No.: 35,270

Kirsten A. Grueneberg, Ph.D.
Registration No.: 47,297

Tel: (703) 413-3000
Fax: (703) 413 -2220
NFO:KAG: